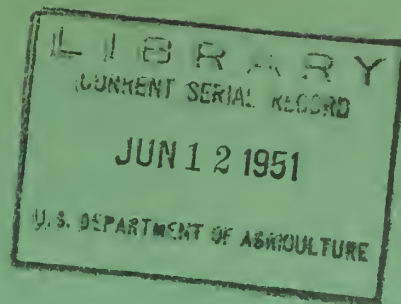


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× GUIDE FOR RESEEDING SUMMER RANGELANDS
ON COLORADO'S WESTERN SLOPE ×

By

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F O R E W O R D

In western Colorado over 400,000 acres of summer rangeland are in need of reseeding. The plant cover on such land has deteriorated to the extent that substantial improvement through grazing management alone would require many years. These lands are producing only a fraction of the forage of which they are capable, and some are eroding. Reseeding offers promise of quickly increasing forage production on these areas, thereby relieving grazing pressure on surrounding areas.

This is a preliminary report to help ranchers and range administrators do a better job of seeding these lands by following the basic principles listed below:

1. Plan for the job

Select good sites. Reseed the more level areas and productive soils first.

Reseed only where the need exists.

Increased forage production is the primary aim of most range reseeding; therefore, management plans, water developments, and fencing for livestock control are essential parts of the reseeding plan.

2. Do a good job

Kill competing vegetation and prepare a good seedbed.

Seed plants that will yield the most and best forage.

Use good seed of high germination and purity.

Get the seed into the ground at the proper rate and depth.

Seed at the proper season.

3. Control grazing

Protect the young plants until they can withstand grazing.

Preserve the reseeded stand by proper grazing management.

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INTRODUCTION

This reseeding guide applies to summer rangelands in Colorado west of the Continental Divide. Specifically, it applies to areas between 8,000 and 11,000 feet elevation where native vegetation has deteriorated to the extent that good livestock-management practices cannot be expected to restore a desirable plant cover within a reasonable time. The recommendations that follow are based on experimental seedings made by the Rocky Mountain Forest and Range Experiment Station from 1946 through 1950, and on results of numerous seedings made by ranchers and by the administrative branch of the Forest Service.

Many sites in need of reseeding are natural livestock concentration areas. Restoration of the grazing capacity of these areas through reseeding, followed by proper grazing management, will tend to reduce grazing pressure on the surrounding lands, and aid in their recovery. Successful reseeding can increase forage production manyfold, usually in a much shorter time than can be accomplished by natural revegetation (figs. 1 and 2).

It is estimated that approximately 5 percent of the summer range in western Colorado is in need of reseeding and can be reseeded by recently developed methods. Some areas cannot be reseeded because of dense brush, steep slopes, or inaccessibility. Most of the remaining summer range can be improved and maintained by proper grazing management. Where improper grazing practices are causing range deterioration, reseeding can accomplish very little until these abuses are corrected. Artificial revegetation is not a substitute for proper grazing management, but goes hand in hand with it.

PLAN YOUR RESEEDING JOB

Range reseeding properly planned is a wise investment, while haphazard reseeding is usually a waste of time and money. The first step in planning your reseeding is to examine the site carefully, and decide whether it meets the following requirements:

1. Other methods of range improvement--proper stocking, change in class of stock, better distribution of livestock, change in season of use, noxious weed or brush control, rodent control, or water spreading--could not accomplish as much as reseeding in the same period of time or at lower costs.
2. Grazing use can be controlled to protect the new seeding.
3. Soils, slopes, and growing season are favorable for reseeding.
4. The area is accessible to the men and machinery needed to do the job. High transportation costs often make seeding impractical in isolated areas.

If it appears that an area can be profitably reseeded, the suggestions made in this guide may help you do the job properly, and increase the chances for success. Recommendations on where, how, when, and what to reseed are given for four types of vegetation: (1) grasslands and parks, (2) aspen, (3) mountain brush, and (4) sagebrush. Different planting methods may be needed for each type, depending upon the native plant cover, soil, and elevation.

WHERE, HOW, WHEN, AND WHAT TO RESEED

GRASSLANDS AND PARKS

Where to reseed.--Mountain grasslands and parks generally occupy level areas with deep soils, and will produce abundant forage if given a chance. Being less rocky than most mountain types, these areas are adapted to use of machinery and are susceptible to good seedbed preparation. Livestock often congregate in open parks and invariably these are the sites most in need of reseeding.

Bare soils, thin stands of secondary grasses, or the abundance of low-value weeds characterize sites that need reseeding. The presence of certain weeds may also indicate the need for an additional treatment or time of seeding that must be observed to obtain successful reseeded stands. Weeds such as tarweed (Madia glomerata), orange sneezeweed (Helenium hoopesi), and others in this category will be discussed later under special weed problems.

How to reseed.--You can reseed grasslands and parks most effectively if you recognize the three basic principles of planting any crop:

1. Eliminate competition from weeds.
2. Make a firm seedbed.
3. Distribute the seeds evenly and cover them.

Naturally, the same degree of tillage can seldom be practiced on low-value rangelands as on cultivated lands. However, it is generally advisable to reduce weed competition in parks and on relatively level areas by plowing or disking.



Figure 1.--This 2-year-old stand of timothy, smooth brome, and perennial ryegrass was planted in Hay Park, White River National Forest, by the Forest Service in 1947. Air-dry yield was over 3,000 pounds per acre in July 1949.



Figure 2.--A 10-year-old crested wheatgrass seeding in Tabeguache Basin, Uncompahgre National Forest, by the Forest Service, indicates the increase in productivity that may be obtained on areas now characterized by much bare ground and numerous annual weeds.

Experimental seedings made in parks on five national forests in 1946 clearly demonstrated that reduction of weed or brush competition is necessary. Broadcasting or drilling seed directly into weedy parks without seedbed preparation always resulted in failures or very poor, slow-growing stands.

The newly developed Brushland plow, the wheatland-type plow, or the heavy offset disk plow are most satisfactory for general range use. Wheatland or offset disk plows should weigh at least 3,000 pounds. For plowing depleted grasslands, 20- to 24-inch disks are satisfactory, but where sagebrush or small shrubs are present, 26- to 30-inch disks are recommended. Disk-type plows should be set to cut 2 to 4 inches deep. Where deep-rooted perennial weeds or low-value native sod grasses are present, plows should be set to cut deeper. Moldboard plows prepare the best seedbeds under these conditions, but are slow and costly to operate. They are not well adapted to rangeland topography and rocky soils. Where soils are compact or brush thick, plowing twice (cross-wise) with disk-type plows usually makes a satisfactory seedbed.

Further seedbed preparation following plowing is dependent upon the characteristics of the site. Most sandy soils, except where clumps of sod are present, will be broken up and settle so that seed can be drilled without further disking or harrowing. Heavier soils are often cloddy after plowing, and disking or harrowing is desirable. Culti-packing or rolling seedbeds to make them firm before seeding will help get more uniform grass stands and prevent waste of seed by covering too deeply. The additional cost of packing can sometimes be avoided by allowing plowed areas to settle naturally before seeding.

In a test with seven different grasses on the Uncompahgre Plateau, higher yields were obtained by disking and packing after plowing. The advantage of packing or rolling was more pronounced with spring planting than with fall planting. This illustrates the beneficial effects of winter snows in firming the seedbed before seed germination.

Drilling is the most satisfactory method for distributing and covering seed. It is just as essential to get seed properly placed in the ground as it is to reduce weed competition. Grain drills, 8 to 12 feet wide, are desirable. Drills with single-disk furrow openers appear to be best suited for use on the loose or trashy seedbeds commonly found on rangelands.

Grass-seed attachments on grain drills are helpful when drilling small-seeded species like timothy, bluegrass, or clover. When attachments are not available, the small seeds can be mixed with sawdust or rice hulls and fed through a regular grain box.

Broadcasting, followed by brush dragging or harrowing, is suitable for seeding areas too rough and rocky for grain drills. Seeder boxes, attached to plows, are usually satisfactory if seeding can be done at the time of plowing. These allow the seed to fall and be covered during plowing, which is generally better than broadcasting ahead of the plow. Some type of drag to cover the seed is recommended when seeds are broadcast behind the plow. Natural soil sloughing sometimes covers the seed on freshly plowed areas, but this is always a gamble. It is best to drill whenever possible.

A planting depth of approximately 1/2 inch is recommended. Seed should not be covered more deeply than 1 inch. Covering too deeply is often responsible for poor stands; it is easy to drill too deeply on freshly plowed seedbeds.

Drill rows spaced 6 to 8 inches apart result in grass stands that prevent invasion of weeds better than wider spacings. Closely spaced plants provide a better ground cover in a shorter time. Forage yields are generally as high from 6-inch row spacings as from wider spacings.

High mountain parks with a poor cover of vegetation which are small, rocky, or isolated, are usually inaccessible to heavy reseeding equipment. On such areas a small pipe harrow, a spike-tooth harrow, or an improvised drag can be used to tear up native vegetation and cover broadcast seed. Such methods may start an area toward recovery, but cannot be expected to produce high-yielding stands of grass in a short time such as would be expected from drilling on a well-prepared seedbed.

When to reseed.---Tests show that summer seedbed preparation followed by seeding in early August results in good reseeded stands. Precipitation and growing conditions are usually favorable for germination and rapid growth of seedlings during August and September. Seedlings commonly become well established, are able to survive the winter, and have a good start to compete with weeds the next spring.

Late-fall seedings (September and October) are generally successful. Since many of the seeds do not germinate until the following spring, seedlings with this early start are able to withstand considerable summer drought. Late-fall seedings, however, seldom develop as rapidly the following year as do early August seedings.

Ordinarily, June is the driest month on western Colorado summer ranges. Early-spring planting is not recommended because of possible June drought damage to new seedlings. In addition, spring planting is seldom practical in the mountains because of wet soils and muddy roads.

What to reseed.---Grasses recommended for seeding in grassland and park types at 8,000 to 10,500 feet elevation are timothy, smooth brome, orchardgrass, and intermediate wheatgrass. Scientific names of these and other plants used in reseeding are listed at the end of this report. A recommended mixture for seeding is shown below:

	<u>Seeding rate</u> (Lbs. per acre)
Timothy	2
Orchardgrass	2
Smooth brome	3
Intermediate wheatgrass	3
Total mixture	<u>10</u>

These rates of seeding apply to drilling good seed on a well-prepared seedbed. Slender wheatgrass, meadow fescue, or perennial ryegrass might be used in addition, or as substitutes in the above mixture. They are well adapted to reseeding in mountain parks, but are rather short-lived.

Mountain brome is also readily established, but it provides little ground cover. Redtop appears to be well adapted to various soils and climatic conditions, but it is not very palatable to livestock. It tends to form a turf that protects the soil until slower-growing grasses become established. Kentucky and Canada bluegrasses are slow in becoming established. They make good ground cover, but are not as productive as the other species. Crested wheatgrass is well adapted to reseeding at the lower elevations on dry sites.

Following is a list of other grasses that appear promising for seeding. They have been tested only in small plots or nurseries:

Pubescent wheatgrass	Red fescue
Beardless wheatgrass	Thurber fescue
Tall or Alta fescue	Big bluegrass
Tall oatgrass	Meadow foxtail
Meadow brome	Reed canarygrass

A legume, seeded in mixture with grasses, improves the palatability of the grass mixture and increases forage yields. The most promising legumes tested thus far are birdsfoot trefoil, red clover, alsike clover, and white clover. At the lower elevations, yellow and white sweetclover are readily established, but often disappear in a few years. These legumes have very small seeds and 1 pound of clover seed per acre is usually sufficient for drilling when mixed with grasses. The seed of most legumes tend to settle to the bottom of a drill box when mixed with coarser seed. They can be seeded best with alfalfa attachments on grain drills.

Special Weed Problems

Some sites are dominated by weeds that require special treatment in order to get grass stands established. The following treatments are recommended for some of the most troublesome weeds:

Tarweed is a shallow-rooted annual. It is easily killed by plowing or disking in the spring or early summer before the plants mature seed. This practice has been successful in Utah and Oregon (3,7). Spring cultivation and seeding were more satisfactory than early summer cultivation and fall seeding in recent tests in Oregon. In western Colorado more reseeding trials on tarweed-infested lands are needed. Preliminary tests indicate that tarweed should be destroyed in the spring, but reseeding may have to be delayed until later in the summer when rainfall is more dependable.

In one test on the Medicine Bow National Forest a tarweed area was plowed in the fall after the plants had matured seed. This resulted in an abundance of tarweed the next spring, and only a thin stand of reseeded grasses. Part of the area was then sprayed with 2,4-D. The 2,4-D killed the new crop of tarweed, and the reseeded grasses grew vigorously (figs. 3 and 4). This illustrates the effect of weed competition in retarding the development of reseeded stands, and indicates a possible way of saving grasses threatened by intense weed competition.



Figure 3.--This timothy was planted October 2, 1946, on the Medicine Bow National Forest. The stand developed slowly and lacked vigor because of intense competition from tarweed. The plot was photographed in September 1948.



Figure 4.--This adjoining timothy plot (planted and photographed on the same dates as figure 3) was sprayed with 2,4-D to kill the tarweed, in 1947. The timothy is much more vigorous than on the unsprayed plot.

Orange sneezeweed is a persistent perennial weed which is poisonous to sheep and unpalatable to cattle. It often occupies depleted parks to the near exclusion of native grasses. Disk-type plowing at a depth of 3 to 4 inches, followed by reseeding, appears to control sneezeweed. Seedbeds should be prepared in early summer before the plants mature seed to avoid planting another crop of sneezeweed. Rapid establishment of reseeded grasses holds invasion of sneezeweed to a minimum. Heavy disking in July 1948 reduced the number of sneezeweed plants by 89 to 97 percent the following year. Different grasses were drilled in 6-inch rows on the disked areas 2 weeks after disking. Timothy produced over 1 ton of air-dry herbage per acre in October 1949. Comparable native range, without benefit of sneezeweed control and reseeding, yielded only 130 pounds of grass at the same date (figs. 5 and 6).

Sneezeweed can also be killed with 2,4-D sprays. Ninety-percent kills have been obtained by a single application of 4 pounds acid 2,4-D (ester form) per acre. The 2,4-D should be mixed with about 50 gallons of water per acre to obtain thorough wetting of the plants. Plants should be sprayed when flower buds are formed and are just beginning to bloom. Spraying at other stages of plant development has been less effective. Most weeds growing with sneezeweed are killed by 2,4-D. Spraying does not injure native grasses, which rapidly increase in density, vigor, and herbage production. In one test, yield of native grasses increased from 90 pounds per acre before treatment to 590 pounds per acre 1 year after spraying. Where native grasses are sparse on sprayed areas, reseeding can be done by drilling directly a few weeks after spraying. The reseeded grasses become established more slowly than on plowed lands, but native grasses are saved.

Hairy goldaster (Chrysopsis villosa) is an unpalatable weed which occurs in nearly pure stands on many summer ranges. Native grasses often show little increase in yield after many years of protection from grazing because of intense competition from this weed (figs. 7 and 8). Plowing or disking 2 to 4 inches deep eliminates most of the hairy goldaster, although disking twice in opposite directions is often necessary for complete eradication. Plowing should be done before the weed matures seed in late summer. The Forest Service reseeded several hairy goldaster parks on the Uncompahgre Plateau in August 1947 by wheatland-type plowing and broadcasting to timothy, smooth brome, and orchardgrass. Two years later, 1,100 pounds of timothy seed was harvested from 30 acres. Herbage yields were nearly 1,500 pounds of air-dry grass per acre.

Hairy goldaster is more susceptible than sneezeweed to 2,4-D sprays. In recent tests, 50- to 80-percent kills of goldaster were obtained by using only 1/2 pound of 2,4-D acid per acre.

Mulesear Wyethia (Wyethia amplexicaulis) has a large tap root and is low in palatability. These plants commonly occur in dense stands but when they mature and dry up much bare soil is exposed. Results from seeding in Wyethia stands on the Targhee National Forest in Idaho (6) indicate that reseeding is successful only when most Wyethia plants are eliminated. Deep moldboard plowing destroyed 75 percent of the Wyethia plants. This method is expensive and limited to deep soils free of rock.



Figure 5.--This sneezeweed-infested area on the Uncompahgre National Forest, was disked and seeded in July 1948. Results of the seeding are shown in figure 6.



Figure 6.--Sneezeweed was nearly eliminated by heavy disking. Timothy (right of sign) grew rapidly after drilling and kept sneezeweed reinvasion to a minimum. The photograph was taken in early November 1949, after a fall snow storm. Smooth brome (left of sign) also made a good stand, but because of its shorter height, is snow-covered.

Shallow, disk-type plowing was not effective. This study showed that 2,4-D ethyl ester, applied at 2 pounds acid equivalent per acre, killed 95 percent of the Wyethia. 2,4-D should be applied at the "half-bloom" stage of development.

ASPEN TYPE

Where to reseed.--The major portion of the aspen type receives at least 20 inches of precipitation annually, and soils and growing conditions are favorable for high yields of forage. Reseeding is justified on areas where range deterioration has advanced so far that much bare soil is evident. Reseeding is also needed on areas where low-value or noxious weeds are abundant.

How to reseed.--Where weed competition is not severe, reseeded under an aspen canopy is a simple operation. Plummer and Stewart of the Intermountain Forest and Range Experiment Station (4) found that broadcasting just before, during, or shortly after leaf fall produced highly satisfactory stands. Seed may be broadcast by Cyclone seeders or by airplane. The falling leaves cover the seed.

Tests on the Western Slope have shown that broadcasting under aspen at time of leaf fall gives good results where the ground has very little native vegetation, or where much bare soil is exposed as a result of gopher diggings. Development of reseeded grasses under aspen is much slower than in open parks where a seedbed is prepared. On aspen ranges that support dense stands of weeds, broadcasting has given very poor results.

Where dense stands of weeds occur, competition must be reduced for successful reseeded. However, closely spaced trees, fallen logs, and roots make the use of plows, drills, and other tractor-drawn equipment impractical. Experimental spraying with 2,4-D indicated that undesirable weeds growing under aspen can be killed. Spraying followed by broadcast seeding on favorable aspen sites may be practical in the future, but present spraying costs are high. Spraying in open parks with mobile equipment costs \$6 to \$8 per acre. Spraying in aspen trees would undoubtedly cost more.

When to reseed.--Broadcast under aspen in September or early October.

What to reseed.--Timothy and orchardgrass appear to be the best species for seeding under aspen, because of their shade tolerance, high seedling vigor, and easy establishment. They can be broadcast in equal mixture at the total rate of 5 to 8 pounds per acre.

Kentucky bluegrass also grows well in the aspen type. Stand establishment is slow, but once started this grass forms a tough sod that resists heavy grazing and trampling. The Intermountain Forest and Range Experiment Station (5) reports the following additional species to be adapted to aspen seeding on the Manti Forest in Utah: smooth brome, bearded wheatgrass, mountain brome, blue wild-rye, tall oatgrass, and slender wheatgrass.



Figure 7.—After 8 years of protection from grazing, this park on the Uncompahgre Plateau still produces very little forage. Competition from hairy goldaster prevents native grasses from spreading. Photograph was taken September 1947.



Figure 8.—One-year-old stands of reseeded grasses in the same park show the quick increase in forage production resulting from reseeding. Photograph was taken September 1948. In 1949, orchardgrass (left) and intermediate wheatgrass (right) produced 600 and 1,200 pounds per acre compared with 120 pounds on the area not seeded

Where to reseed.--The mountain-brush type is commonly a mixture of scrub oak (Quercus gambelli), serviceberry (Amelanchier spp.), snowberry (Symphoricarpos spp.), chokecherry (Prunus spp.), wildrose (Rosa spp.), and other shrubs. Precipitation, growing season, and soils in the type are well suited to the production of reseeded grasses. In western Colorado the upper portion of this type is often mixed with the ponderosa pine type, and the lower portion blends with the pinyon-juniper type. For information on reseeding parks and openings in the ponderosa pine zone in Colorado, see Rocky Mountain Station Paper No. 3 (4), and for seeding pinyon-juniper lands see Rocky Mountain Station Paper No. 4 (1).

In the mountain-brush type, choose the better sites for reseeding--the comparatively open parks, the more level benches, basins, and valley bottoms. Steep slopes and stands of dense brush should generally be avoided. However, reseeding of freshly burned-over land is desirable for erosion control and increased forage, regardless of steepness of slope.

How to reseed.--For best results, all relatively open areas should be plowed or disked to eliminate weed competition. Seed should be drilled if possible; if broadcast, seed should be covered.

The Brushland plow does a fairly good job of preparing a seedbed in mountain brush, but even this heavy plow may ride over the taller brush without uprooting it. The Caterpillar Fleco root rake has proved efficient but costly for uprooting shrubby plants in the Ragged Mountain area near Paonia, Colorado.

Areas recently burned can be seeded most economically by broadcasting in the ashes. Seeding should be done soon after the fire before rains compact the ashes or wash them away. Trials near Somerset, Colorado, with orchardgrass, smooth brome, yellow sweetclover, and meadow fescue indicate that stand establishment may be slow. Where scrub oak is present, the rapid sprouting of this brush after burning decreases the value of reseeding for forage production. Burning as a means of destroying the brush cover and preparing a seedbed is not recommended.

Small parks often are interspersed with mountain-brush thickets. An excellent reseeding job was done by the Forest Service on such an area in Tabeguache Basin in the summer and fall of 1948. Approximately 1,000 acres were seeded, one-third of which was in small parks. All the parks were plowed with a heavy disk-type plow. Seed was broadcast over both parks and brush thickets with Cyclone hand seeders. Parks were then rolled with a corrugated cultipacker to cover the seed. The falling oak leaves provided a cover and mulch for seed in the thickets. Forage samples collected in parks in August 1949 showed yields of 1,500 to 2,200 pounds of air-dry herbage per acre. In 1950, samples showed yields of 1,900 to 3,300 pounds per acre on the same area. This represented an increase in forage production of 15 to 20 times over the depleted native vegetation. Plant development was much slower under the scrub oak, but many seedlings were evident.

When to reseed.--July and August appear to be the best months for seeding on prepared seedbeds. Seedlings usually become established before the end of the growing season, and are better able to compete with weeds the next spring.

What to reseed.--Adaptation trials at two locations, 25-Mesa and Sanborn Park on the Uncompahgre National Forest, indicate that the grasses listed below are promising. Both reseeding sites are at elevations of 8,000 feet and have sandy loam soils.

Crested wheatgrass	Tall oatgrass
Intermediate wheatgrass	Timothy
Slender wheatgrass	Smooth brome
Tall wheatgrass	Orchardgrass
Big bluegrass	Red fescue

SAGEBRUSH TYPE

Where to reseed.--The sagebrush type on summer rangelands commonly occurs in relatively small areas interspersed among mountain brush and timber types. Most of the depleted areas that need reseeding occur at elevations below 9,000 feet where big sagebrush (Artemisia tridentata) is the dominant plant. Vigorous plants of big sagebrush indicate deep, well-drained soils capable of producing high forage yields. At elevations above 9,000 feet, silver sagebrush (Artemisia cana) is more common, and is often associated with shrubby cinquefoil (Potentilla fruticosa) in openings in the spruce-fir timber. Although a few silver sagebrush areas might be profitably reseeded, the majority of these subtypes need only proper grazing management to maintain or improve forage production (figs. 9 and 10).

How to reseed.--Considerable reseeding work has been done in the sagebrush type in western Colorado, and methods have been well tested. However, much of the work has been done on spring-fall ranges below the elevational limits of the summer range. Bulletin 413-A by Colorado A & M College (2) makes the following recommendations that apply to summer ranges:

1. Kill the sagebrush by plowing to a depth of 2 to 4 inches with a Brushland or wheatland-type plow or heavy offset disk. Plow when the sage is dry, and before the sage is ripe.
2. Drill seed with a single-disk grain drill. Where the seedbed is too rough and trashy for operating a drill, broadcast seed and cover with a drag. Use 25 to 50 percent more seed when broadcasting.
3. Do not plant seed more than 1 inch deep. A planting depth of 1/2 inch is recommended for most species.
4. Drill in 6-inch rows for best control of weeds and brush.
5. Seed adapted species.

When to reseed.--The best time for seeding is from August to early October, before fall storms hinder seeding operations.

What to reseed.--Recommended species for reseeding are listed below. Promising species that may be tried are also shown. The recommended rates of seeding refer to drilling good seed of a single species on a good seedbed.

<u>Species</u>	<u>Rate of seeding</u>
RECOMMENDED	(Lbs. per acre)
Crested wheatgrass ^{1/}	7
Intermediate wheatgrass	9
Pubescent wheatgrass	9
Smooth brome	10
Orchardgrass ^{2/}	5
Timothy ^{2/}	4
PROMISING	
Amur wheatgrass	9
Tall wheatgrass	9
Beardless wheatgrass	9
Bearded wheatgrass	10
Slender wheatgrass	8
Tall oatgrass	10
Mountain brome	10
Meadow brome	10
Russian wild-rye	8
Tall or Alta fescue ^{2/}	6
Red fescue	6
Birdsfoot trefoil	4
Yellow or white sweetclover	4
Big bluegrass	5

^{1/}Recommended for drier sites below 9,000 feet elevation

^{2/}Recommended for moist sites

RESEEDING COSTS

Costs of reseeding depend on the price of seed, cost of labor, and the amount of ground preparation and fencing needed. In recent years seeding costs on summer ranges averaged \$3 to \$18 per acre, consisting of:

	<u>Per-acre cost</u>
Seed	\$2.00 to \$5.00
Drilling or broadcasting	0.50 to 1.50
Plowing	2.50 to 7.00
Packing, harrowing, etc.	0 to 2.00
Fencing	1.00 to 6.00

Airplane seeding of aspen is the cheapest method. When landing strips are located near the area to be seeded, costs may be as low as \$3 per acre, exclusive of fencing. In 1949, the Forest Service in the Intermountain Region seeded 44,000 acres at an average cost of \$6.30 per acre, and in the Rocky Mountain Region they seeded 5,000 acres at a cost of \$7.22 per acre.



Figure 9.--This dense stand of silver sagebrush is on the Grand Mesa National Forest at an elevation of 10,000 feet. The area had been heavily grazed for many years, but a thin cover of native grass remained at the time it was fenced and photographed in 1941.



Figure 10.--The area shown in figure 9 was fenced and protected from grazing for 8 years. The vigor and production of native grasses increased greatly as shown in the above photograph taken in 1949. Reseeding is not recommended on sites that may recover under improved grazing management within a relatively short time.

All newly seeded areas should be protected from grazing until the plants have become well established. Although some good stands of reseeded grasses have been obtained under continuous grazing use, they have been the exception rather than the rule. Reseeded plants should be allowed to mature seed, expand and develop their root systems, and thicken in stand before they are grazed. This usually requires at least two growing seasons.

After the reseeded plants are ready for grazing they should be utilized according to sound principles of range management. Graze at the proper season. Wait until the leafage is well developed, the plants are growing vigorously, and the soil is dry enough to prevent cutting by the animal's hoofs. Leave enough of the plant (about 50 percent) to maintain plant vigor and protect the soil.

Many reseeded areas on summer ranges are comparatively small (50 to 300 acres) and scattered because of the need for reseeding only where the native plant cover has deteriorated. Naturally, small areas surrounded by large tracts of native range, will be severely overgrazed and damaged by livestock unless grazing use is carefully regulated. Reseeding will not solve this problem. Reseeding and the use of reseeded areas must be tied in with over-all grazing management to obtain maximum benefits. Fencing, water developments, season of use, and stocking rates on both the reseeded and surrounding native range are as important as where, how, when, and what you plant.

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SUMMARY OF RESEEDING RECOMMENDATIONS

Type	Site : qualifications	Seedbed preparation : and seeding methods	Time of : seeding	Recommended : species ^{1/}
Grasslands and parks	Relatively level, with much barren soil, thin grass stands or low-value weeds.	Plow in summer and drill.	Early August	Timothy Orchardgrass Smooth brome Intermediate wheatgrass
	Tarweed, hairy goldaster, sneezeweed abundant	Plow in spring or early summer before weeds mature seed. 2,4-D may be useful.	July or early August	
	Wyethia abundant	Plow 6 to 8 inches deep or spray with 2,4-D	July - August	
Aspen	Much bare soil exposed. Sparse weed cover	Broadcast at time of leaf fall	September and early October	Timothy Orchardgrass
Mountain brush	Small openings, parks, and mesas	Plow in summer and drill (broadcast under oak thickets)	July to October	Wheatgrasses: Crested Intermediate Slender Tall Smooth brome Big bluegrass Tall catgrass Timothy Orchardgrass Red fescue
	Recent burns	Broadcast in ashes	Soon after fire	
Sagebrush	Preferably below 9,000 feet. Big sagebrush dominant.	Plow in summer when sage is dry and brittle, before seed is ripe. Drill.	August to early October	Wheatgrasses: Crested Pubescent Intermediate Smooth brome Timothy Orchardgrass

^{1/} See text for additional species suggested for seeding

SCIENTIFIC AND COMMON NAMES OF PLANTS
used for reseeding, with number of seeds
per pound, in thousands^{1/}

<u>Scientific name</u>	<u>Common name</u>	<u>No. seeds per lb., in thousands</u>
Agropyron amurense	Amur wheatgrass	---
cristatum	Crested wheatgrass	175
elongatum	Tall wheatgrass	79
inermis	Beardless wheatgrass	150
intermedium	Intermediate wheatgrass	88
trachycaulum	Slender wheatgrass	159
trichophorum	Pubescent wheatgrass	100
smithii	Western wheatgrass	110
subsecundum	Bearded wheatgrass	117
Agrostis alba	Redtop	4,990
Alopecurus pratensis	Meadow foxtail	576
Arrhenatherum elatius	Tall oatgrass	150
Bromus carinatus	Mountain brome	71
erectus	Meadow brome	71
inermis	Smooth brome	136
Dactylis glomerata	Orchardgrass	654
Elymus glaucus	Blue wild-rye	137
junceus	Russian wild-rye	175
Festuca elatior	Meadow fescue	230
elatior arundinacea	Tall or Alta fescue	227
rubra	Red fescue	615
thurberi	Thurber fescue	---
Lolium perenne	Perennial ryegrass	227
Lotus corniculatus	Birdsfoot trefoil	375
Melilotus alba	White sweetclover	260
officinalis	Yellow sweetclover	260
Phalaris arundinacea	Reed canarygrass	533
Phleum pratensis	Timothy	1,230
Poa ampla	Big bluegrass	882
compressa	Canada bluegrass	2,495
pratensis	Kentucky bluegrass	2,117
Trifolium hybridum	Alsike clover	700
pratense	Red clover	275
repens	White clover	800

^{1/} From 1948 Yearbook of Agriculture "Grass."

